

A NOTE UPON THE INSUFFICIENCY OF THE OPERCULUM AS A BASIS OF CLASSIFICATION IN ROUND-MOUTHED SHELLS.

(Continued).

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The naturalists who subsequently worked upon the classification of the mollusca were all sensibly influenced by these observations, and the operculum became a diagnostic note in the separation of genera. Troschel (1847) and Pfeiffer (1852), thoroughly applied this method of discrimination, and augmented the number of genera. M. Petit de la Saussaye (1850) questioned the significance of the operculum as a real generic feature, and especially so far as the nature of the substance of the operculum had been used by Pfeiffer to distinguish genera. He says (*Journal de Conchyliologie*, Vol. I., 1850) "the nature more or less calcareous or corneous of the opercula arises rather from accidental circumstances, such as the habitation of these animals, their nourishment, the character of the ground upon which they live, the force of the sun, etc. As to the variable form of the volutions of the spire, observed in these accessory parts, it doubtless arises from the modifications, that the tissue secreting them presents; modifications which do not seem adequate for the establishment of generic groups."

Benson reiterated the importance of the operculate features of the round-mouthed shells, and the system of classification incorporated in H. and A. Adams, "Genera of Recent Mollusca" (1858) still further imbedded in the science the critical relations of the form and substance of the operculum to the natural limitations of the genera.

In the latest important systematic treatise, Tryon's Structural and Systematic Conchology, the operculum is perhaps less exhaustively used for descriptive purposes, but the author remarks that the operculum "presents many beautiful modifications of structure, characteristic of the smaller groups, which are often peculiar to limited regions as in the Helicidæ."

In an examination of this group of shells in the general collection of the American Museum of Natural History and representing the Jay, Haines, and Constable cabinets, the somewhat exaggerated importance of the separative features of their opercula seemed apparent.

It is quite evident that the opercula vary in substance and form; that these variations are related to groups and genera; that in some instances (*Opisthoporus*, *Stoastoma*) they present in one family a unique and generally well-maintained uniformity of structure. But their determinative character has been overestimated. The prominent characters of the opercula are repeated in diverse sections of the entire group, and the elements of their composition are more nearly significant of habitat than they are of systematic differences in the shells themselves.

It is noteworthy in this connection to recall the demonstration made by Blanford (*Annals & Mag. Nat. Hist.*, 1869), that the opercula of *Georissa* (Blanford's genus) and *Hydrocena* Parreyss are almost identical, whereas the former shell is entirely terrestrial, and the latter marine.

(A note of importunity to traveling or exploring naturalists may be appropriately inserted here. The character of the environment of species or genera of land shells is generally not closely enough observed. The moisture, temperature, mineral nature of the ground, seasonal features, and frequency and amount of sunlight, the vegetation, are all influential factors in the physiological life of shells. They do, in land shells especially, have a clearly marked relation to the coloring, thickness and operculum of the shells, and they are not as particularly dwelt upon by collectors as they might be, both for the purpose of elucidating the effect of environment and the sometimes misleading rules of systematists.)

Poey has called attention (*Memorias sobre la Historia Natural de la Isla de Cuba*) to a striking illustration of local influence in the sierras of the Isle of Pines. The Sierras de Casas and de Caballos are respectively a short distance to the west and east of Nueva-Gerona; in the latter region the shells display regular spires, and the crustaceans are destitute of spinose surface, as *Trochatella stellata*, *Pineria beathiana*, *Cyclostoma pupoides*, among the shells; *Oniscus* sp.? among the crustaceans. In the former area the *Trochatella* is represented by a denticulate, roughened, and loosely coiled shell (*constellata*); the *Pineria* resembles a screw (*terebra*); the *Cyclostoma* separates its last volution (*moreletianum*), and the *Oniscus* presents spiny asperities, preserving otherwise a very similar appearance to the de Casas species.

The geological formations are identical, and Poey has suggested

the differing intensity of the sun's rays as a partial explanation of these surprising differences.

This same author has protested against any sweeping conclusions as to the importance in the operculate shells of the operculum, in establishing genera, and agrees with Petit de la Saussaye in considering this feature of quite subordinate value, remarking, "porque varia el operculo de los *Cyclostomas* en los grupos mas aproximados por el caracal y las costumbres del animal. No suce de asi en los turbineos, entre los cuales se nota que los que viven apegados a los arrecifes tienen el operculo corneo, y los que se apartan a mayor profundidad lo tienen calcareo: de aqui un excelente caracter para diferenciar las *Litorinas* de los verdaderos turbos y trocas."

Poey has also pointed out the confusion that results from the adoption by different authors of varying or diverse morphological characters for the classification of this group.

A *Cyclostoma* becomes a *Chondropoma* because of a corneous operculum, or the same shell a *Megalostoma* by its thickened peristome, a character participated in by the *Cyclophorus* of Montfort, and the *Tropidophora* of Troschel.

It is perhaps interesting to recall that Poey in a protest against classification based upon the shelly parts of these mollusca, has called attention to the method of progression of the *Cyclostomas*, their divided pedal muscle allowing the movement forward of one-half of the foot alternately with the other. It is not at all likely that this feature would ever be useful in separating the round-mouthed shells, but Poey has made of this observation an opportunity to emphasize the preponderant significance of the physiology of molluscs over the form, etc., of their shells for purposes of classification. *Cyclophorus* has not a divided foot. Pfeiffer, in his *Monographia Pneumonopomorum Viventium*, analyzes the *Cyclostomacea* as composed of three series, in each of which the form of the operculum is regarded as the separative character. The entire systematic table is as follows, so far as the opercula are here discussed.

FIRST SERIES.

Operculum circular, frequently concave exteriorly, formed of many slowly-increasing whorls. Nucleus central.

I. Operculum shelly (testaceous).

Genera, *Cyclotus*, *Alycæus*, *Diplommatina*.

Cyclotus. Operculum orbicular, shelly, arctispiral, externally rather con-

cave, with the margin of the whorl thickened, or raised in an incurved lamina, nucleus subcentral.

Alycæus. Operculum circular, substestaceous, obsoletely multispiral.

Diplommatina. Operculum substestaceous, thin, with few whorls, outer edge with thin lamella.

II. Operculum cartilaginous?

Genus, *Pterocyclos*. Operculum subcartilaginous, multispiral, interiorly concave.

III. Operculum corneous.

Genera, *Craspedopoma*, *Aulopoma*, *Cyclophorus*, *Leptopoma*, *Megalomastoma*, *Cataulus*, *Pupinella*, *Pupina*, *Registoma*, *Callia*.

Craspedopoma. Operculum horny, solid, closely whorled. Nucleus central, external lamina plane, internal furnished in its last whorl with a circular prominence, centre profoundly concave.

Aulopoma. Operculum horny, arctispiral, planorbial composed of two laminae, with an intermediate channel, with the last whorl furnished interiorly with a circular groove. (The outer edge larger than the aperture and reflexed over the peristome of the shell.—Adams.)

Cyclophorus. Operculum horny, thin, arctispiral, externally more or less concave.

Leptopoma. Operculum membranous, arctispiral, flat.

Megalomastoma. Operculum subcircular, thin, horny, arctispiral, planular.

Cataulus. Operculum orbicular, plane, corneous, arctispiral.

Pupinella. Operculum horny, arctispiral.

Pupina. Operculum thin, membranous, arctispiral, subplanum.

Registoma. Operculum circular, thin, horny, arctispiral.

Callia. Operculum thin, membranous, arctispiral.

(To be continued.)

NOTES.

HELIX HORTENSIS ON MAGDALEN ISLAND.—In 1901 the Carnegie Museum of Pittsburg sent an expedition to the Magdalen Islands and Labrador to collect birds and eggs, and on June 23d, while at Grand Entry, Magdalen Island, one of the party collected a lot of *Helix hortensis* Müll., which show a remarkable tendency towards a single type of banding. There are about 330 shells in the lot, counting young and old, and all are the form with yellow ground. The following table, based on matured shells only, gives the number of each form:

186—12345.

48—(12)345.